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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2002953539 for a patent by GRAHAM PICKERING and GARY YEWDALL as filed on 23 December 2002.

WITNESS my hand this  
Twentieth day of January 2004

A handwritten signature in cursive script, appearing to read "J. Billingsley".

JULIE BILLINGSLEY  
TEAM LEADER EXAMINATION  
SUPPORT AND SALES



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# FLEXIBLE TRAINING WHEEL ASSEMBLY

## CLAIM

An improved, flexible training wheel assembly to be fitted to the rear wheel axle of a bicycle for providing lateral dynamic stability of the bicycle, a pair of such wheel assemblies to be used concurrently on opposite sides of the rear wheel, each said wheel assembly comprising:

An auxiliary wheel attached to the lower arm,

A lower arm,

A visco-elastic connector attached to the lower arm and the upper bracket,

An upper bracket attached to the visco-elastic connector at the lower end and removeably attached to the bicycle axle at the top end.

- 1.1 The upper bracket having a slotted hole to allow vertical adjustment of the wheel assembly to allow adjustment of the amount of pre-load applied to the flexible joint, to suit the weight and / or skill level of the rider.
- 1.2 The visco-elastic connector having a spring effect to allow the rider to lean the bicycle when turning but to progressively oppose the lean of the bicycle, to assist the novice to maintain balance.
- 1.3 The visco-elastic connector having an inherent damping effect to absorb energy and damp out undesirable oscillation / vibration.
- 1.4 The visco-elastic connector having greater stiffness of the spring character in the fore and aft direction to ensure that the training wheel remains substantially parallel to the bicycle rear wheel during use. This may be achieved by having two axi-symmetric connectors side by side (in fore and aft direction) or by having a single connector with significantly greater dimension in the fore-aft direction than in the lateral direction.

## DESCRIPTION

### FIELD OF THE INVENTION

The invention relates to the flexible training wheel assembly that is attached to the rear wheel of the bicycle to assist children to develop the balancing skill necessary to ride a bicycle.

### BACKGROUND OF THE INVENTION

Commercially available training wheel assemblies typically comprise rigid brackets rigidly attached to the bicycle rear wheel axle. This rigidity inhibits the learning process. If the wheels are set low, the bicycle cannot be leaned at all, either to make a turn or just to compensate for riding on a cambered surface. If the wheels are set high the bicycle will lurch from side to side in an unnerving manner and, once the rider is leaning on one outrigger wheel, there is no restorative force acting to encourage the rider to regain the central equilibrium position.

A number of patents have been registered showing various designs, which attempt to address this problem. Most of the configurations proposed incorporate a suspension system based on the concept of a pivoted bracket supported by a spring, with the various fittings and fasteners required to retain the spring, whilst permitting the desired range of movement.

Some of these devices are quite complex and cumbersome, for example that disclosed in U.S. Pat. N° 4810000. In this design, the training wheels are raised and lowered by cables attached to the front wheel forks of the bicycle, which activates the cables as the front wheel

is turned. As well as complexity and cost, this device has the added drawback that the movement of the training wheels is reliant upon correct adjustment of the mechanism, rather than simply responding to the normal lean of the rider.

Simpler, more viable designs typically employ a hinged bracket supported by a compression spring, plus the necessary fittings and fasteners. Typical of these devices are those disclosed in U.S. Pat N° 's 5064213, 5100163 and 5352403.

These designs appear to be functional, however, since none appear to have been commercialized their principal drawback would seem to be cost to manufacture; they also have a "gadgety" appearance, which may not appeal to the market.

More importantly, the exposed coil spring design presents numerous pinch-points for trapping and injuring small fingers, which is a significant drawback.

The simplest design is that disclosed in U.S. Pat. N° 6113122 and previously in Pat. N° 5707069. It's main feature is that it combines the structural support of the outrigger wheel and the flexible spring action desired in the one element, namely a helically wound torsion spring.

This design appears to be functional and relatively cheap to manufacture. However, it may lack torsional rigidity about the vertical rod part of the member, allowing excessive fore and aft movement of the outrigger wheel. This would be especially so if the assemblies were installed back to front (ie. on the wrong sides), as the helical spring would then tend to open, rather than close.

The assemblies would need to be marked clearly "Left" and "Right" hand and would need to be installed correctly so. In addition, the steel torsion spring has virtually no inherent damping available to damp out unwanted oscillations or vibration.

#### **SUMMARY OF THE INVENTION**

It is an object of the present invention to provide a stabilizing device for bicycles that also allows the novice rider to develop a natural feel for the behaviour of a bicycle, particularly over uneven or sloping ground.

It is another object of the present invention to provide a stabilizing device for bicycles that is simple in construction and economical to manufacture.

It is another object of the present invention to provide a stabilizing device, as described above, that is easy to install and easy to adjust to reduce in effect, as the skill of the rider increases.

The present invention has an upper bracket member and a lower arm member flexibly joined via a visco-elastic connector, which allows for angular movement between the two members, provides a spring force to progressively oppose the angular displacement and has inherent damping characteristics to damp out unwanted oscillations / vibration.

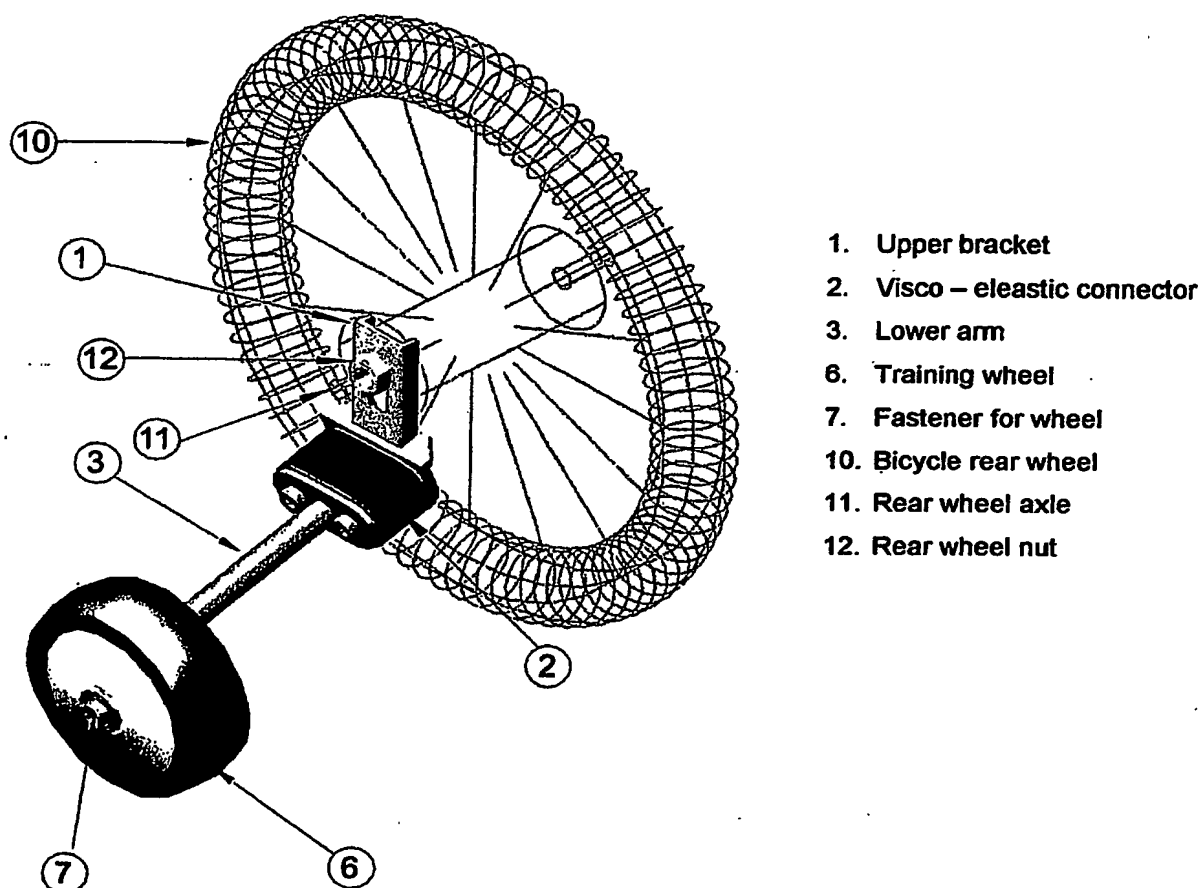
The upper bracket has a slotted hole near its upper end to allow the bracket to be attached to the rear wheel axle and for the position of the bracket to be adjusted vertically. The geometry of the assembly is such as to apply a pre-load to the flexible connector when the bicycle stands upright, under the weight of the rider. The amount of pre-load may be adjusted to suit the weight and / or skill level of the rider, by adjusting the height of the upper bracket via the slotted hole.

The upper bracket is also shaped to fit over an inner, lugged guide bracket, which allows the upper bracket to be adjusted vertically whilst maintaining its correct, substantially vertical orientation.

The training wheel is attached to the outer end of the lower arm, in a conventional manner.

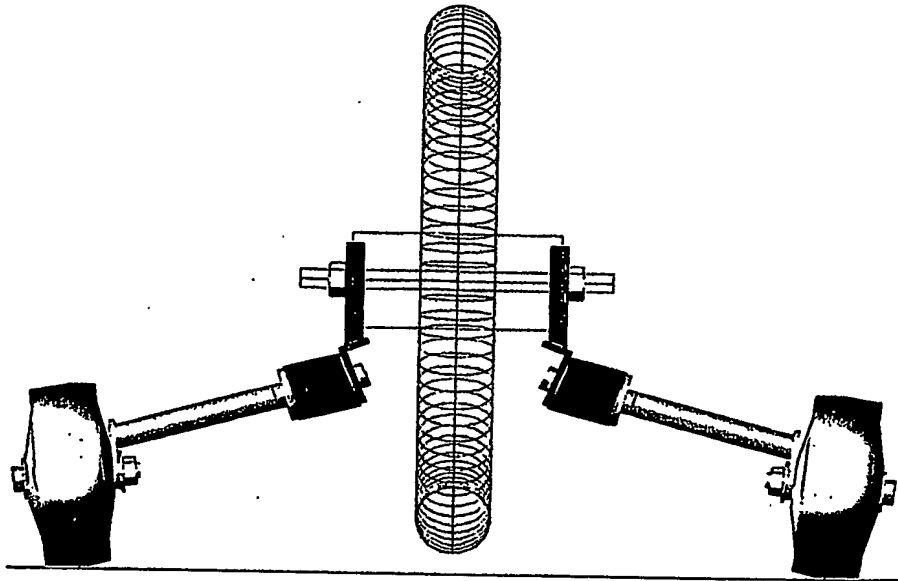
## DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing the training wheel assembly fitted to the rear wheel of a small bicycle, in accordance with the present invention. The upper bracket (1) is connected to the bicycle rear wheel axle (11), secured by the wheel nut (12). The height of the bracket is adjusted to apply a pre-load the flexible connector (2), by lowering the bracket to the desired degree beyond the point at which the wheel (6) first makes contact with the ground.



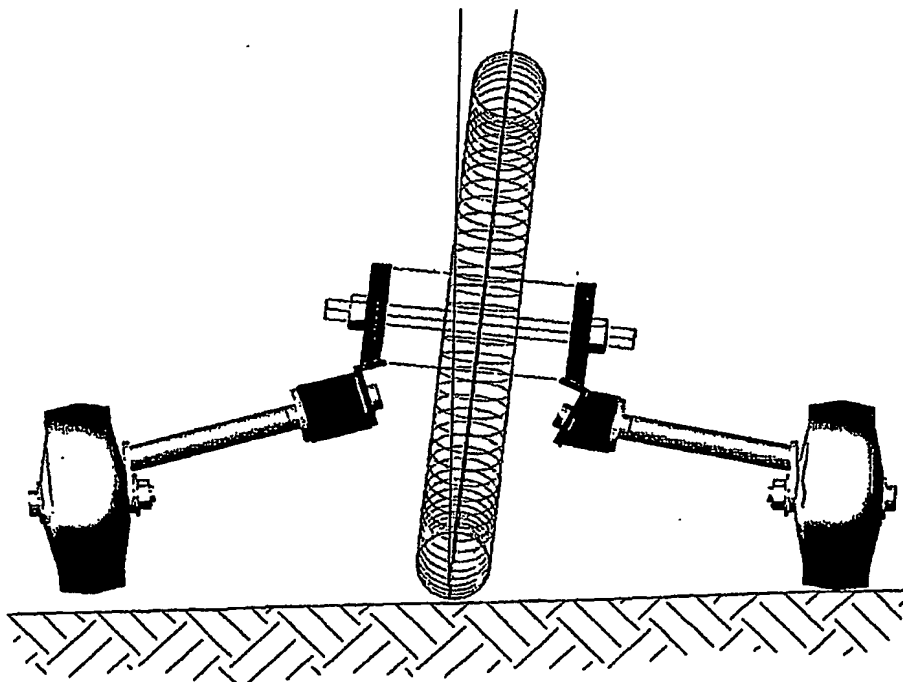
**Fig 1. Training wheel assembly connected to bicycle rear wheel axle – perspective view**  
(NB. One assembly only shown; two assemblies required, one each side of rear wheel)

Fig. 2 is a rear view showing the training wheels (6) positioned to apply a suitable pre-load to the flexible connector (2). Without the weight of the rider, the bicycle rear wheel will typically be clear of the ground. Under the added weight of the rider, the flexible connector(s) will deflect and the bicycle rear wheel will make contact with the ground.



**Fig. 2. Training wheels in un-loaded state but positioned for pre-loading by the weight of the rider – rear view**

Fig. 3 is a rear view showing the training wheels linkages deflecting to accommodate the bicycle wheels leaning into a turn, on an uneven surface. In this way, the rider is able to develop a natural feel for the balance required to ride a bicycle whilst still being supported by the spring force in the flexible connector elements (2).



**Fig. 3. Training wheel linkage flexing as bicycle is leaned into a turn, on a cambered surface – rear view**

Fig. 4 is a perspective view showing the linkage assembly, with the wheel omitted for clarity.

The upper bracket (1) is channel shaped in the upper portion, to allow it to locate around the guide bracket (5), yet move vertically for adjustment. The lower portion slopes backward so that its face makes an angle to the vertical (about  $20^{\circ}$  -  $30^{\circ}$ ) to achieve a suitable geometry for the linkage, depending upon the diameter of bicycle wheel and diameter of training wheel in question.

The visco-elastic connector (2) is bonded or fastened to the lower face of the upper bracket. The visco-elastic connector has a dimension in the fore-aft (x) direction of approximately twice the dimension in the vertical (z) direction. The dimension in the lateral direction (y) is selected to be compatible with x & z dimensions. All dimensions and the type and hardness of the polymer compound are selected to give the desired spring rate. (Perhaps two different models may be required to cover the range of bicycle sizes and weights of riders.)

The lower arm (3) is bonded or fastened to the visco-elastic connector (2), at its upper face plate.

The lower end of this member has a tab bracket or similar provision for accepting the wheel fastener (bolt, typically). The face of this tab bracket is set at an angle to the lower arm (about  $70^{\circ}$ - $90^{\circ}$ ) to ensure that the alignment of the axis of the training wheel matches the rest of the geometry of the linkage assembly and that the training wheel is approximately vertical under typical pre-load conditions.

The lower arm is sized to carry the loads imposed upon it and to meet the required geometry of the linkage.

The guide bracket (5) is a conventional type, either solid or channel shaped, with a hole through the centre for the rear wheel axle to pass through. The guide bracket also has a lug on one side, sized to mate with the slot in the typical bicycle rear fork.

When this lug is correctly located in the slot, the guide bracket is prevented from rotating, ensuring that the training wheel assembly remains in the correct, substantially vertical, alignment. The design of the present invention is sufficiently robust that its function is not significantly affected by alignment variations normally encountered from bicycle to bicycle.

The guide bracket is sized to fit neatly within the channel section of the upper bracket (1).

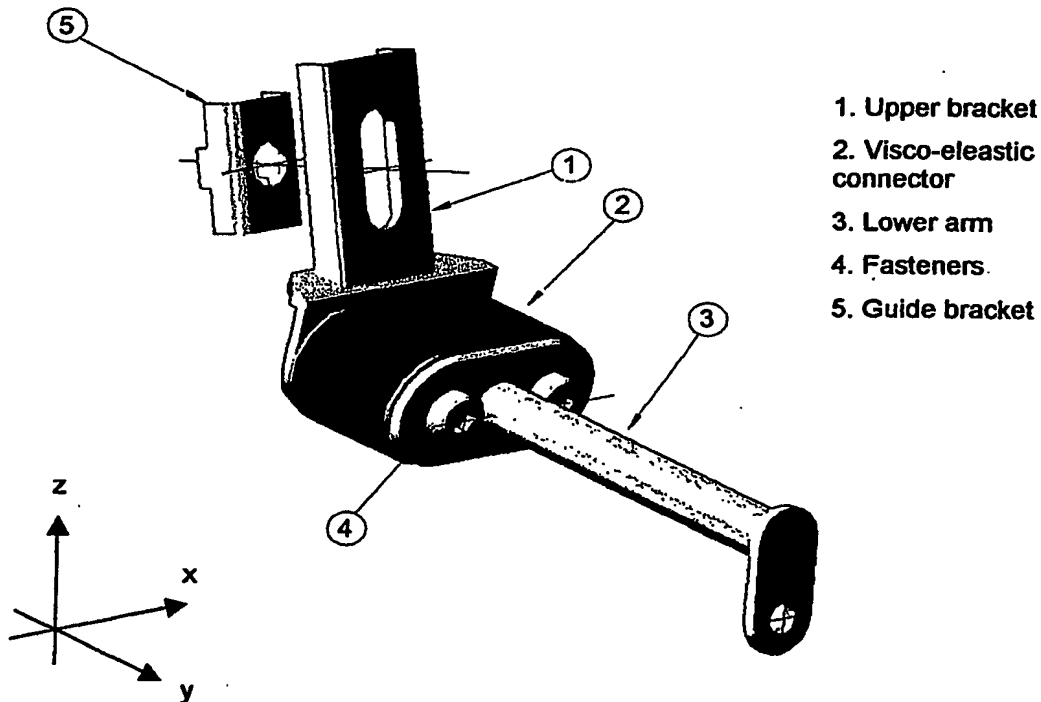


Fig. 4. Training wheel linkage assembly (wheel omitted for clarity) – perspective view